MEE427 PID Control – Extraction of Motor Model with System Identification Procedure using Data Acquisition (DAQ) Instrument and Implementation of PID Control to DC Motor

Required equipment for system identification procedure:

1. Computer (LabView and necessary drivers should be installed before)
2. Data acquisition device (will be given in the laboratory)
3. DC Motor (will be given in the laboratory)
4. DC Motor Driver (will be given in the laboratory)
5. Power Supply (will be given in the laboratory)
6. Potentiometer (will be given in the laboratory)
7. Necessary connection cables (bunch of different types of jumper cables)

PLEASE FOLLOW THE STEPS GIVEN BELOW

The purpose of this work is to collect position data of a DC motor with given input voltage by using a potentiometer as a feedback device. Extracted input-output relation is used in revealing the motor model by using the system identification procedures.

A simple way to collect the required data is using LabView program and a DAQ device which is compatible with LabView. NI MyDAQ and NI USB-6009 data acquisition devices are compatible with LabView program (NI: National Instruments). These devices have Analog and Digital inputs/outputs, providing an easy connection to computer via USB cable.

Figure: NI MyDAQ Student and NI USB-6009 portable DAQ devices

The related quick start documents with the mentioned software and hardware are given below:

- https://learn.ni.com/learn/article/labview-tutorial
- https://www.ni.com/en-tr/shop/hardware/products/mydaq-student-data-acquisition-device.html
- http://www.csun.edu/~rd436460/Labview/USB%206008%20Users%20Guide.pdf

The software part should follow the steps in order:

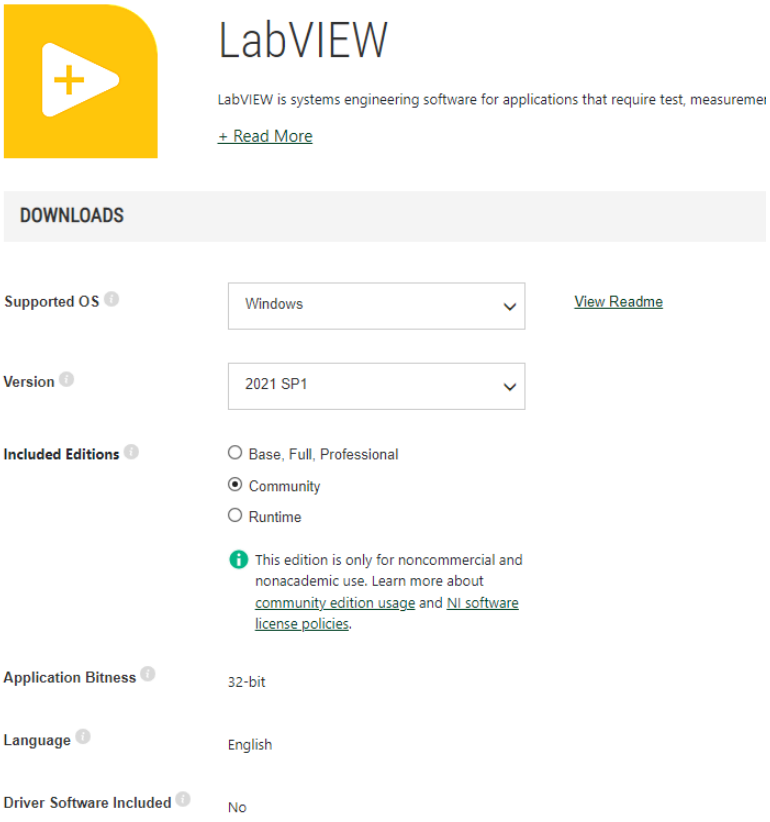
1. Installing LabView
2. Installing NI-DAQmx (includes DAQ device drivers and LabView integration)

NOTE: 1) It is very critical to use compatible software versions.
2) Installing LabView program as 1st step is a must.

1. *Installing LabView*

NOTE: It requires an account to run LabView. If an account does not exist, sign up and create an account.

Download and install LabView from its official website. The version should be 2021 SP1 and the edition should be "Community" version (free version). The version number is decided through hardware compatibility chart. A verification screenshot from the install website is given below.



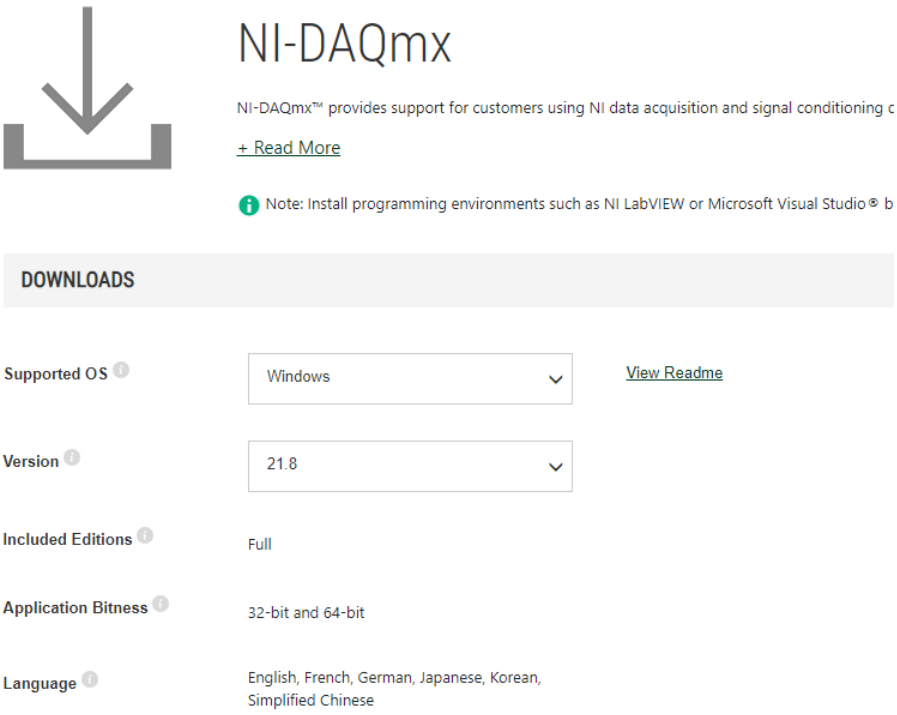
https://www.ni.com/en-tr/support/downloads/software-products/download.labview.html#443310

Operations of NI-based programs (LabView and NI DAQ devices are included) like installation, update, remove, etc. are carried out using "NI Package Manager". However, it is not recommended for this application due to software-hardware compatibility, the latest versions are not compatible with each other at this moment.

A brief LabView tutorial may be followed using quick start guide whose website link was given before.

2. *Installing NI-DAQmx*

Download and install NI-DAQmx from its website. The version should be "21.8". The version number is decided through hardware compatibility chart. A verification screenshot from the install website is given below.



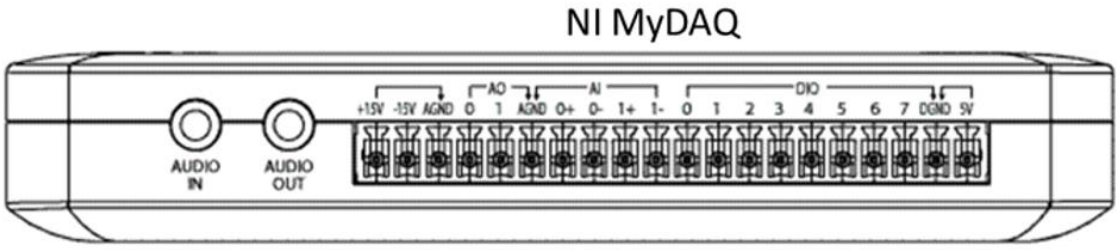
https://www.ni.com/en-tr/support/downloads/drivers/download.ni-daqmx.html#445931

NOTE: Using DAQ device without LabView is also possible using NI-ELVIS program (NI-ELVISmx), providing a few working modes (not needed in this application).

DATA LOGGING STEPS

The purpose of the preliminary work on given DC motor is to determine the relation between the input and output. The procedure should be followed as below;

- One of the Analog inputs of the DAQ device should be connected to position feedback sensor (encoder).
- The DC motor should be driven with a known input voltage and output position should be logged by constructing a related LabView program via DAQ device. The exact execution timing of the input voltage should be controlled as well.
- Input output relation should be logged by constructing a related LabView program via DAQ device.
- A connection schematics for DAQ device is given below.



Control Design Procedure

The purpose of the project is to have an overall experience in practical PID control on an armature controlled DC motor. While following the procedure to reach the ultimate goal, it is expected to have experience on system identification procedures, data processing, mathematical approaches and microcontroller application with control algorithms in practical way.